

PATENT APPLICATION  
1620/76982

I hereby certify that this paper is be-  
posited with the United States Postal  
Service as Express Mail in an envelope ad-  
dressed to: Assistant Commissioner for Pat-  
ents, Washington, D.C. 20231, on this date.  
29 DEC 1999 V Hughes

Date E L 133 503809 US  
Express Mail Label No.

CAP AND CONTAINER ASSEMBLY

BACKGROUND AND SUMMARY

This invention relates to containers which can be opened and closed repeatedly and continue to achieve a good seal between the cap and the container.

A good seal is especially desirable if the substance in the container needs protection from the outside environment, such as a powdered beverage mix which can cake with continuous exposure to very humid air. It is desirable to be able to manufacture an inexpensive cap and container assembly, which can be used for initial packaging of the product prior to sale, and which can continue to be opened and resealed by the purchaser of the product.

Some existing containers are too expensive for the packaging of inexpensive products, difficult to reseal effectively, or simply cannot be resealed effectively.

The present invention is a novel cap and container assembly which can repeatedly achieve a good seal. Annular protrusions depend from a curved cap top, and the top of the container neck slants out, then in, and then out as the neck extends down from the mouth of the container. As the cap is secured to the container, the protrusions engage exterior and interior surfaces of the neck, and the curved cap top and the upper part of the neck flex to facilitate forming a good seal. Stopping surfaces form a positive stop to lower engagement of the cap with respect

1 to the container beyond a certain point, limiting the temporary  
2 deformation of shape caused by the flexing. The dimensions of  
3 the protrusions and the neck surfaces are matched to achieve a  
4 good seal at the lowest engagement of the cap with respect to the  
5 container permitted by the stopping surfaces.

6 The features of the present invention which are believed to  
7 be novel are set forth below with particularity in the claims.  
8 The invention, together with further advantages thereof, may be  
9 understood by reference to the following description in  
10 conjunction with the accompanying figures, which illustrate some  
11 embodiments of the invention.

#### 12 BRIEF DESCRIPTION OF THE DRAWINGS

13 FIG. 1 is a side perspective view of the cap and container  
14 assembly with the cap secured to the container.

15 FIG. 2 is a top perspective view of the cap and container  
16 assembly.

17 FIG. 3 is a cross-sectional view taken along line 3-3  
18 depicted in FIG. 2.

19 FIG. 4 is an enlarged view of the identified portion in FIG.  
20 3.

21 FIG. 5 is a similar view as illustrated in FIG. 4, but of an  
22 alternative embodiment.

DETAILED DESCRIPTION

FIGS. 1 through 4 show an example of the present cap and container assembly. It comprises a container 10 and a cap 20 designed for mating engagement with each other. The container 10 and cap 20 are manufactured as molded plastic parts, preferably composed of polypropylene, polyethylene, or similar materials.

As best seen in FIG. 3, the container 10 includes a base 11 and a neck 12. The neck 12 is the portion of the container 10 to which the cap 20 is engaged, and the end of the neck 12 defines a mouth of the container. The cap 20 includes a curved top 21 and a skirt 22 depending peripherally from the top 21. A portion of the exterior surface of the neck 12 is threaded, a portion of the interior surface of the skirt 22 is threaded, and the cap 20 can be secured to the container 10 by mating engagement of those two threaded-portions. A number of stops or projections 23 on the interior surface of the skirt 22 are designed to contact a shoulder 13 on the exterior surface of the neck 12 at a certain point as the cap 20 is secured to the container 10. Those projections 23 and shoulder 13 act as stopping surfaces to stop any lower engagement of the cap 20 with respect to the container 10 and to provide a gap 14 between a bottom edge of the cap 20 and an upper part of the base 11. In FIGS. 3 and 4, the shoulder 13 is seen above the threaded portion of the exterior surface of the neck 12.

As best seen in FIGS. 3 and 4, a relatively long sealing flange or first annular protrusion 24 and a plurality of much

smaller second annular protrusions 25 depend from an interior surface of the top 21. The top 21 is generally convex as viewed from inside the cap 20. The neck 12 is substantially symmetrical about a central vertical axis. As the neck 12 extends down from the mouth, it is preferable if the neck 12 initially doubles back creating a flexible lip and then has a lower interior sealing surface 17 for sealing with the first protrusion 24, before extending down to the threaded portion. That is, the neck 12 initially becomes wider forming an upper exterior sealing surface 15 at an angle of about 10° to about 20°, and preferably about 15°, with an imaginary horizontal plane in an unstressed state. The second annular protrusions 25 are positioned to engage this upper exterior sealing surface 15 of the neck 12. It is preferable that the neck 12 then become narrower first forming an exterior surface 16 at an angle of about 10° to about 25°, and preferably about 20°, with an imaginary horizontal plane, and second becoming more vertical while continuing to narrow and forming the lower interior sealing surface 17 at an angle of about 10° to about 20°, and preferably about 14°, with a surface of an imaginary vertical cylinder (in an unstressed state). The first annular protrusion 24 can engage this lower interior sealing surface 17 of the neck 12. The neck 12 can then become wider than the lip as it continues down to meet the base 11.

The surfaces 15, 16, and 17, like all of the neck 12 in the example illustrated by FIGS. 1 through 4, curve symmetrically about a central vertical axis. However, the surfaces 15, 16, and

1 17, may be characterized as generally frusto-conical. That is,  
2 in a cross-sectional view taken along any plane which includes  
3 the central vertical axis, the surfaces 15, 16, and 17 would  
4 appear as straight line segments. As seen in FIG. 4, the angle  
5 of surface 15, 16, or 17, mentioned above, would be the angle of  
6 such a straight line segment - as represented by angles  $\alpha$ ,  $\beta$ , and  
7  $\gamma$ , respectively.

8 With the example just described, and illustrated in FIGS. 3  
9 and 4, the first annular protrusion 24 will protrude down further  
10 from the top 21 than the second protrusions 25, as both are  
11 designed to engage and seal with a particular surface area of the  
12 neck 12. It is preferable that materials and the geometry of the  
13 top 21, the first protrusion 24, and the neck 12 render them  
14 sufficiently flexible to allow for some temporary deformation of  
15 shape. This is facilitated by the curvature of the top 21 and  
16 the bends in the neck 12. The temporary deformation results from  
17 the pressure exerted as the cap 20 is secured to the container  
18 10. The resilience of the materials used maintains that pressure  
19 and the resulting good seal between the cap 20 and the container  
20 10.

21 It is preferable that the angles, of the first annular  
22 protrusion 24 and of the lower interior sealing surface 17 of the  
23 neck 12 with which the first protrusion 24 will engage, are  
24 generally matched to achieve a good seal at the lowest engagement  
25 permitted by the stopping surfaces 13 and 23. Similarly, as seen  
26 in FIGS. 3 and 4, the lengths of the second annular protrusions

1 25 will vary to match the angle of the upper exterior sealing  
2 surface 15 of the neck 12 with which the second protrusions 25  
3 will engage. Of course, the particular configuration described  
4 is only an example and is not the only one which will work. Upon  
5 engagement, the interior surface of the top 21 will be pressed  
6 upward, and the upper exterior sealing surface 15 will be pressed  
7 downward putting inward pressure on the lower interior sealing  
8 surface 17 and on the first protrusion 24.

9 In addition to facilitating a good seal, the shape of the  
10 neck 12, as best seen in FIG. 3, is ergonomically desirable. A  
11 typical opened container 10 may be held easily with one hand  
12 around the neck 12 below the flexible lip.

13 As seen in FIG. 3, a bottom section of the neck 12 is  
14 generally vertical, and its exterior surface includes the  
15 threaded-portion below the shoulder 13. That bottom section of  
16 the neck 12 is narrower than the adjacent and integral upper part  
17 of the base 11, and the skirt 22 is generally the same diameter  
18 as the upper part of the base 11.

19 As best seen in FIGS. 1 and 3, a gap 14 remains between a  
20 bottom edge of the cap 20 and an upper part of the base 11 in the  
21 illustrated embodiment, when lower engagement of the cap 20 with  
22 respect to the container 10 is blocked by contact between the  
23 stopping surfaces 13 and 23. The gap 14 facilitates the cutting  
24 of any label or tamper-evident tape applied to the filled cap and  
25 container assembly before sale to the consumer.

1 In an alternative embodiment illustrated, in part, in FIG.  
2 5, an additional annular protrusion 26 depends down from the  
3 interior surface of the top 21. When the cap 20 is engaged with  
4 the container 10, the additional protrusion 26 is radially  
5 outside of the flexible lip of the neck 12, and is sufficiently  
6 rigid and extends low enough and close enough to the lip to  
7 resist the lip from moving outwardly when the lip is pressed down  
8 upon engagement of the cap 20 with the container 10. The curved  
9 cap top 21 flexes up, causing the rigid additional protrusion 26  
10 to press the flexible lip inwardly. This will maintain the  
11 pressure on the sealing surfaces 15 and 17, and improve the  
12 sealing between the upper exterior sealing surface 15 and the  
13 second protrusions 25 and between the lower interior sealing  
14 surface 17 and the first protrusion 24. The additional annular  
15 protrusion 26 will compensate for manufacturing imperfections,  
16 such as a surface of the neck 12 being slightly out of the round,  
17 which would diminish the ability to achieve a good seal. The  
18 possibility of such imperfections cannot always be eliminated  
19 given the tolerances achievable in the manufacture of inexpensive  
20 containers.

21 The embodiments discussed and/or shown in the figures are  
22 examples. They are not exclusive ways to practice the present  
23 invention, and it should be understood that there is no intent to  
24 limit the invention by such disclosure. Rather, it is intended  
25 to cover all modifications and alternative constructions and

embodiments that fall within the spirit and the scope of the invention as defined in the following claims:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----